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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/594,997	01/24/2007	Takahito Itoh	0026.1225	3293

49455 7590 04/30/2010
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EXAMINER

HU, HENRY S

ART UNIT	PAPER NUMBER
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1796

NOTIFICATION DATE	DELIVERY MODE
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04/30/2010

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

usptomail@smiplaw.com

Office Action Summary	Application No. 10/594,997	Applicant(s) ITOH ET AL.	
	Examiner HENRY S. HU	Art Unit 1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Election of February 1, 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 is/are pending in the application.
- 4a) Of the above claim(s) 4-7 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3 and 8 is/are rejected.
- 7) ☒ Claim(s) 2 is/are objected to.
- 8) ☒ Claim(s) 1-8 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 January 2007 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This Office Action is in response to **Election** filed on February 1, 2010, which is in response to Restriction requirement filed on December 31, 2009. **Applicants have elected Group I, Claims 1-3 and 8 without traverse.**
2. This Application is a **371/PCT/ JP05/006967** with a Japanese priority at April 9, 2004. No Pre-Amendment is applied. **Two IDS**' (2 pages each) are filed so far. Examiner **accepts Applicants' four drawing sheets with Figures 1-4, as Applicants alleged a brief description for drawing is clearly on page 8.** **Claims 1-8 are pending now with three independent claims (Claim 1, Claim 4 and Claim 5), while non-elected Claims 4-8 (Groups II and III) are all withdrawn from consideration.** An action follows. ("X" and "Y"-cited references are found in international search report for Applicants' priority document **WO 2005/099010 A1 to Itoh et al. for PCT/JP2005/006967**)

Claim Objections

3. **Claim 2 is objected to** because of the following informalities (Applicants may want to correct the specification as well):

On **Claim 2**, the **general formula 1** is improper according to MPEP since it is without any definition on the factors m, n, R and the end group "*". Based on the fact that a hyperbranched polymer has an acidic functional group disposed at a terminal of a side chain, the "R" group in the pendent aromatic ring is a functional group accordingly.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

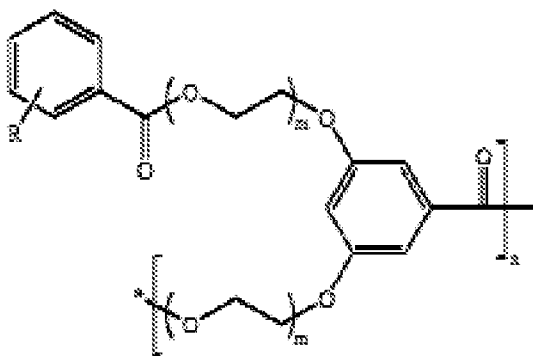
A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. The limitation of parent **Claim 1** in present invention relates to ***a solid-state polymer electrolyte membrane***, characterized in: *that a primary constituent of which is ***a hyperbranched polymer*** having an acidic functional group disposed at a terminal of a side chain thereof.*

According to its dependent **Claim 2**, said hyperbranched polymer is related to ***a poly (bis(oligo-ethylene glycol) benzoate)*** expressed by general formula 1 below.

(general formula 1)



See other limitations of dependent **Claims 2-3 and 8**.

6. **Claims 1 and 8 are rejected** under 35 U.S.C. **102(b)** as being anticipated by **Chen** et al. (Polymer Journal, vol. 35(3), pp. 280-285 (2002)).

The “**polymer electrolyte membrane (PEM)**” of parent **Claim 1** “comprises” **a primary constituent** of which is **a hyperbranched polymer having an acidic functional group disposed at a terminal of a side chain** thereof. According to dependent **Claim 2**, said hyperbranched polymer is **a poly (bis(oligo-ethylene glycol) benzoate)** expressed by general **formula 1**. However, the **general formula 1** is improper according to MPEP since it is disclosed without any definition on the factors m, n, R and the end group “*”. Additionally, since a hyperbranched polymer has an **acidic** functional group disposed at a terminal of a side chain, the “R” group in the pendent aromatic ring accordingly can be in **two** ways including: (A) R is a functional group directly attached on the aromatic ring, and (B) R is a functional group-containing group. The attachment to the aromatic ring is via a connecting bivalent group.

7. **Chen** et al. have already prepared some **polymer electrolyte membranes** comprising **a hyperbranched polyimide-type dendritio polymer** having some functional groups disposed **at a terminal of a side chain** thereof. In a very close examination on **Scheme 2 at page 282**, the main chain is indeed hyperbranched via the connector of **1,3,5-tris(4-aminophenoxy)benzene (TAPOB)**, **while the sulfonic acid functional group is the endgroup of the side chain** since the terminal aromatic ring is sulfonated.

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8. To be specific, see page **282** at front for introducing the sulfonic acid groups on the aromatic rings; see detailed synthesis on the whole **Experimental** part; also see page **283** at end section for its application in making solid state polymer electrolyte membranes. Therefore, Chen clearly anticipates current limitation of parent Claim 1 and its dependent Claim 8.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

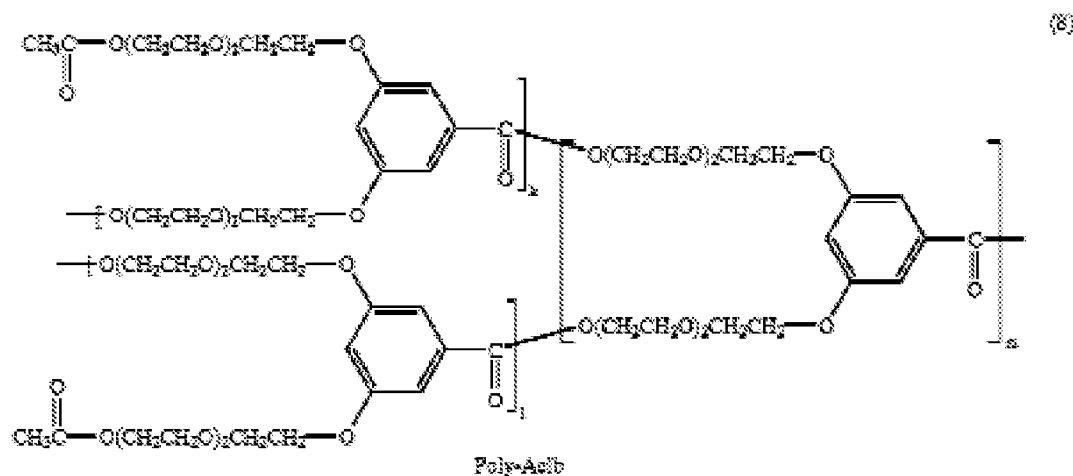
10. **Claims 1-3 and 8** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Ito** et al. (US 6,924,067 B1 with US filing date at April 9, 2003) or **Itoh** et al. (Journal of Power

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Sources, vol. 81-82, pp. 824-829 (1999)), in combination or alone in view of **Colombo** et al. (US 2006/0094792 A1 with US effective filing date at March 27, 2001).

The “**polymer electrolyte membrane (PEM)**” of parent **Claim 1** “comprises” **a primary constituent** of which is **a hyperbranched polymer having an acidic functional group disposed at a terminal of a side chain** thereof. According to dependent **Claim 2**, said hyperbranched polymer is **a poly (bis(oligo-ethylene glycol) benzoate)** expressed by general **formula 1**. However, the **general formula 1** is improper according to MPEP since it is disclosed without any definition on the factors m, n, R and the end group “*”. Additionally, since a hyperbranched polymer has an **acidic** functional group disposed at a terminal of a side chain, the “R” group in the pendent aromatic ring accordingly can be in **two** ways including: (A) R is a functional group directly attached on the aromatic ring, and (B) R is a functional group-containing group. The attachment to the aromatic ring is via a connecting bivalent group.

11. **Two** references including **Ito and Itoh** in combination or alone has already prepared some **polymer electrolyte membranes** comprising **a hyperbranched polymer having some functional groups disposed at a terminal of a side chain** thereof. In a very close examination on Ito’s **Formula (8)** on column 13-14 at lines 42-60 or on Itoh’s **Scheme 1** at page 826, **the main chain is hyperbranched via the connector of dihydroxy benzoate, while the acetyl ester functional group is the endgroup of the side chain** since the terminal is acetylated. See Ito (067) at column 8, line 1 – column 9, line 40; particularly see column 9, line 35-40. Also see Itoh at Experimental part.



12. The acetylation is achieved by the reaction with acetyl chloride in the presence of methylamine in dichloromethane at room temperature. Although the acetyl ester is a functional group according to the art, it still cannot be counted as acidic functional group. Therefore, **Ito** and Itoh in combination or alone is “only” silent about having the acidic functional group disposed at the terminal of the side chain as specified in parent Claim 1.

13. **Colombo** alone can teach such a subject matter. For instance, Colombo has prepared some **Frechet-type dendrimeric polymers** in the form as network structure so as to be useful in making ion-conducting membranes. Said polymer has **acid as functional endgroups** as well as its **main chain is hyperbranched via the connector of dihydroxy benzoate**. See abstract and Fig. 1. By doing so, it would allow the use of higher concentrations of methanol, which would increase the fuel efficiency of the DMFC power source (see paragraph 0005 at the end).

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14. In light of the fact that all involving references are dealing with the preparation and using of aromatic hyperbranched polymers **via the connector of dihydroxy benzoate**, one having ordinary skill in the art would therefore have found it obvious to modify **Ito or Itoh's** process of making aromatic hyperbranched polymer by synthetic efforts so as to carry the same or similar acid as endgroup as taught by **Colombo**. By doing so, better and more diversified solid electrolyte membranes for DMFC) with improved efficiency may be thereby obtained.

15. Dependent **Claims 2 and 3** relate to the specific preparation of aromatic hyperbranched polymers **via the connector of dihydroxy benzoate**, while dependent **Claim 8** relates the application in making **solid-state polymer electrolyte fuel cell**. They are thereby rejected with the same rationale as discussed above in the rejection of parent Claim 1.

Conclusion

16. The prior art made of record and not relied upon is considered pertinent to applicants' disclosure. The following references relate to a solid-state polymer electrolyte membrane, characterized in that a primary constituent of which is a hyperbranched polymer, which can be related to a poly (bis(oligo-ethylene glycol) benzoate): **US 7,038,004 B2 to Chen** et al. only discloses the polymerization process of making fluorinated poly(arylene ethers) with pendant crosslinkable groups. See title, abstract and Figures 5 and 6. **Although the fluorinated polymers can be counted as hyperbranched polymer according to the art, they are not sulfonated at all on the aromatic rings.** Therefore, Chen fails to teach or fairly suggest the solid electrolyte membrane limitation of parent Claim 1.

17. Any inquiry concerning this communication or earlier communication from the examiner should be directed to **Dr. Henry S. Hu whose telephone number is (571) 272-1103**. The examiner can be reached on Monday through Friday from 9:00 AM –5:00 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dr. Vasu Jagannathan, can be reached on (571) 272-1119. The **fax** number for the organization where this application or proceeding is assigned is **(571) 273-8300** for all regular communications. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Peter D. Mulcahy/
Primary Examiner, Art Unit 1796

/Henry S. Hu/
Examiner, Art Unit 1796

April 25, 2010